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EVALUATION OF SOME OLIVE HYBRIDS DERIVED FROM A BREEDING PROGRAM

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ABSTRACT

The Egyptian olive industry requires new selected genotypes to address the need of modern production. In order to produce new genotypes for table olives, olive oil, or dual purpose varieties, breeding program was initiated in Egypt in 1994, by crossing between local and foreign cultivars.

During three years progenies from crosses between cvs. (Chemlali x Aggizi), (Aggizi x Kalamata) and (Aggizi x Koronaiki) were evaluated. The progenies have been analyzed for traits of the tree (shoot length, shoot thickness, number of nodes/shoot, internodes length (cm), the leaves (average number of leaves/shoot, leaf surface area, leaf shape) , flowering (flowering time , the length of inflorescence , number of total flowers/inflorescence, number of perfect flowers/ inflorescence, number of staminate flowers/ inflorescence, sex ratio, and fruit set/m,), fruiting (production, fruit shape, fruit weight, stone weight, flesh weight ,flesh/stone, moisture and oil content(oil percent in fresh weight and oil percent in dry weight) and rooting ability .From the obtain data it can be concluded that some valuable selections have been resulted. Such Progenies were No.24 ,26, 27and 31 for table olive; progenies No 7, 10, for oil and No. 33, 38, 39 for dual purpose. Conclusion

Thus, all the best selected progenies were propagated and planted in three locations, to evaluate their performance in different geographical areas. Performance included i.e., tree growth, yield, fruit characteristics, oil content and oil compositions in fatty acids. There comes the necessity to study quantitative and qualitative traits of olive production.

Keywords: Olive, progenies, table olive, cross breeding, Aggizi ,Chemlali, Kalamata ,Koroneiki

INTRODUCTION

Today the market demands for cultivars with a high ecological plasticity, adaptable to new agronomical techniques, capable of producing high quality oil and for big table olive with good flavors and good technological properties. It is possible to enlarge the natural genetic variability of the olive through the cross breeding technique in which searching for interesting genotypes is aimed (Bellini *et al.*, 2002).

In this context, any genetic improvement program by cross breeding will need strong efforts and long time to obtain next generation besides its agronomical evaluation in the field. The length of the juvenility period has been traditionally one of the main drawbacks of fruit tree breeding including olive. However, in the last years, several methodologies aimed at shortening the length of the juvenile period have been approached, thus facilitating the progress of the breeding process. (Lavee *et al.*, 1996 and Santos-Antunes *et al.*, 1999). This has promoted the developmental process of olive breeding programs in the main olive producing countries (Leon *et al.,* 2006).

In olive, few breeding programs by crossing and selection in the progenies have been initiated in the past decades (Lavee ,1990; Bellini, 1992; Arsel & Cirik, 1994 and Panneli *et al*., 2006). As a consequence, several new cultivars have been released such as Barnea (Lavee *et al*., 1986) Fs-17 (Fontanazza *et al.* ,1998) Maalot (Lavee *et al* ., 1999) "Arno, Tevere and Basento" (Bellini *et al.,* 2000) and Askal (Lavee *et al*., 2003).

Comparative field trials of advanced selections from breeding programs are currently carried out in several olive producing countries (Bellini, *et al.*, 2000; Sonnoli *et al.*, 2003; Lavee *et al.*, 2004 and Alfei *et al.*, 2008). A morphological scheme of primary descriptors which proved to be suitable for distingwishing cultivars has been used to determine 262 cultivated olive varieties (Rallo, 1995).The secondary characterization of many cultivars is already underway as regards some criteria such as growth, productivity and fruit parameter (Del Rio and Caballero, 1994) and resistance to abiotic factors such as calcareous soils, drought and salinity (Corderio., 1997 and Cresti *et al.*, 1997).

The objective of this breeding program was to obtain new olive cultivars with some preferable traits such as early bearing, high productivity and oil content, resistance to pest and diseases, vigor suitability for mechanical harvesting and high quality of olive oil. Therefore, an olive breeding program has been initiated in 1996 at Giza, Egypt using Aggizi as Egyptian mother olive cultivar for Kalamata as one of the most important Greek black table cv. and Koronaiki as a Greek oil cv., both of them as pollinizers.

Meanwhile, "Chemlali" a Tunisian oil cv., was used as a mother plant for Aggizi. The resulting progenies were planted during 2000 season in the orchard of the Horticulture Research Institute at Giza, Egypt and evaluated during the 2005, 2006 & 2007 growing seasons.

MATERIALS AND METHODS

The evaluated progenies in this study were derived from crosses between cvs. Aggizi x Kalamata, Aggizi x Koronaiki and Chemlali x Aggizi planting at the orchard of Horticulture Research Institute during 1996 and 1997 (Table 1).

The seedlings were planted on Sept. 25th 2000 at the same orchard with planting distance 4 x 4 m apart Seedlings have a very long juvenile phase (15-20 years)under natural conditions to begin bearing fruit. In order to shorten the length of the juvenility period, the plants must attain sufficient height and should be grown in the erect position. They should be maintained in a continuous growing phase and pruning should be avoided as far as possible with the exception of the lowest branches. Fertile substrates should be used with abundant fertilization when the seedlings reach the transition phase (i.e. from the juvenile to adult phase), which is characterized by the disappearance of the wild traits and the appearance of traits corresponding to the mature phase and the plants become potentially fertile. Standard cultural practices were followed including irrigation and fertilization.

Table (1): Number of progenies derived from crosses combination.

Selections	♀ **X** ♂
2	Chemlali x Aggizi
3	Chemlali x Aggizi
4	Chemlali x Aggizi
6	Chemlali x Aggizi
7	Chemlali x Aggizi
10	Chemlali x Aggizi
16	Aggizi x Kalamata
18	Aggizi x Kalamata
19	Aggizi x Kalamata
20	Aggizi x Kalamata
24	Aggizi x Kalamata
26	Aggizi x Kalamata
27	Aggizi x Kalamata
28	Aggizi x Kalamata
31	Aggizi x Kalamata
33	Aggizi x Koronaiki
38	Aggizi x Koronaiki
39	Aggizi x Koronaiki

The following characters were addressed by using the methodology for primary and secondary characterizations of olive cultivars proposed by the International Olive Council (Barranco *et al.*, 2000). Twenty shoots were labeled on each seedling in different directions to study shoot growth, flowering, fruiting. Thirty fruits from previously tagged flowers were randomly collected at the time ripening index to ovoid the influence of the ripening stage on fruit traits and rooting ability.

- Characters of the tree:

Shoot length, shoot thickness, number of nodes/shoot, internodes length cm. were carried out.

- Characters of the Leaves:

Average number of leaves/shoot, the leaf surface area and leaf shape were worked out.

- Leaf Shape: This was determined by the ratio between the lengths (L) and the width (W).

- Elliptic: L/W < 4, Elliptic-lanceolate: L/W 4-6, lanceolate: L/W **>** 6.

- Flowering:

Flowering time, the length of inflorescence, number of total flowers/inflorescence, number of perfect flower/inflorescence, number of staminate flowers/ inflorescence, , sex ratio, fruit set/m. were carried out.

- Fruiting:

At production, fruit shape, fruit weight, stone weight, flesh weight and flesh/stone. Moisture and oil content (oil content in fresh weight, oil percent in dry weight) were evaluated.

Fruit shape: This was determined by the ratio between the lengths (L) and the width (W).

Spherical: L/W < 1.25, Ovoid: L/W 1.25-1.45, Elongated: L/W > 1.45.

Fruit weight: very low < 2 g, low 2-4 medium 4-6 g, high 6-8 g, very high > 8 g.

Flesh/stone: low < 5, medium 5-7.5, high 7.5-10, very high > 10. Rooting ability: Leaf stem cutting to be taken from trees on "off" years (in the middle of spring or late summer) and treated with 3000 ppm indolebutyric acid (IBA).

The following categories have been established according to the international olive council (Barranco *et al.*, 2000).

Rooting (%): nil 0, very low 1- 20, low 20-40 medium 40-60 high 60-80, very high 80-100.

RESULTS AND DISCUSSION

- Characters of the tree

1-Shoot length:

Concerning the shoots length the data in Fig. (1) indicated that progenies No. 28, 16 derived from cvs. (Aggizi x kalamata) had the longest shoots than parental cultivars .As well as progeny No 3, derived from cvs. (Chemlali xAggizi) had also the longest shoots than parental cultivars, while the progeny No 38 derived from cv. (Aggizi x Koronaiki) had the lowest shoot length than the parental cultivars.

2- Shoot thickness:

Regarding shoot thickness, data in Fig. (2) showed that the shoots of progenies No. 28, 27, 31, 16 (Aggizi. x Kalamata.) had the thicker value as will as, No 33 (Aggizi x Koronaiki)), more than the values of cvs. Aggizi , Kalamata , and Koronaiki. On the other side, shoot of progeny No. 20 (Aggizi x Kalamata) had the thinnest value .The standard error is ranging from 0.02 to 0.33.

3- Number of nodes/shoot:

Concerning the average number of nodes/shoot, data in Fig. (3) showed that the progenies no. 16, 28, 31 24, derived from (Aggizi x Kalamata), and no 33 derived from (Aggizi x koronaiki) gave the highest number of nodes and higher value than cv. Aggizi comparing to all other progenies.

4- Internodes length (cm.):

Respecting internodes length was evident from Fig. (4) that the progenies no. 3, 4 (Chemlali x Aggizi), and no. 26, 27, 18 (Aggizi x Kalamata) gave the longest internodes length than cvs. Aggizi, Chemlali and Kalamata, while the shortest length was found in progeny no. 33 (Aggizi x K**- Characters of the leaves**

The leaves were examined for a number of characters but we will only focus on the most important.

1- Average number of leaves/shoot:

It is obvious from Fig. (5) that the progenies No. 16, 28, 31 (Aggizi x Kalamata) and No. 33 (Aggizi x Koronakia) gave the highest value than the cvs Aggizi, Kalamata and Koronaiki, while the lowest value was obtained by progeny No. 19 (Aggizi x Kalamata)

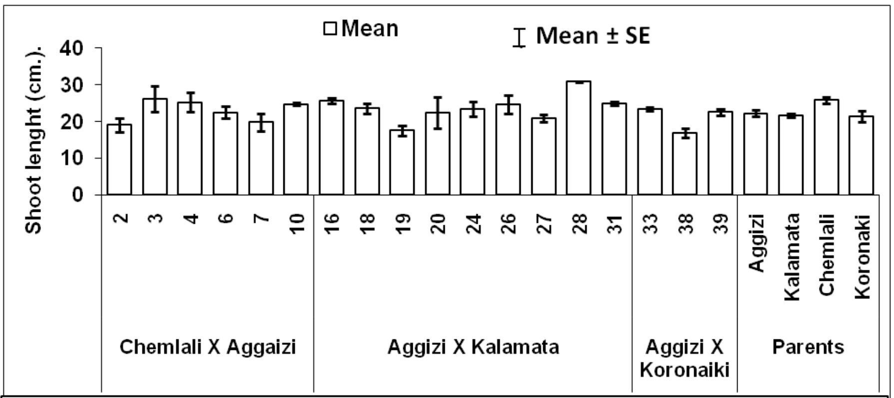

Fig. (1): Mean and standard error during three seasons for shoot length (cm.) of the olive progenies.

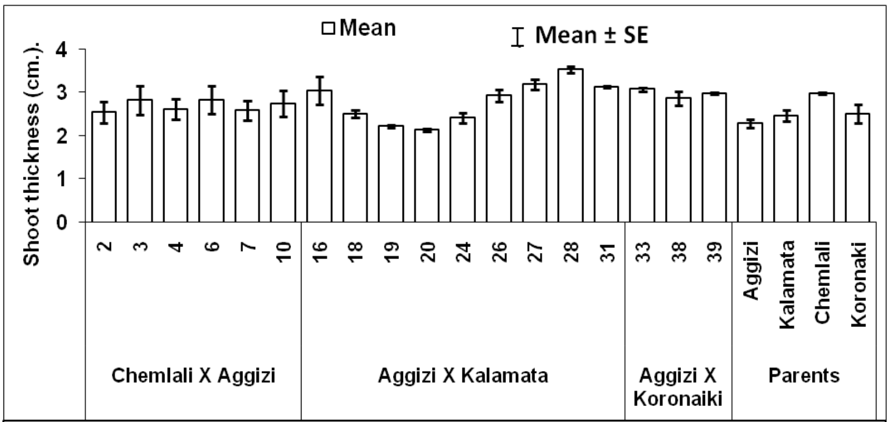

Fig. (2) : Mean and standard error during three seasons for shoot thickness (cm.) of the olive progenies.

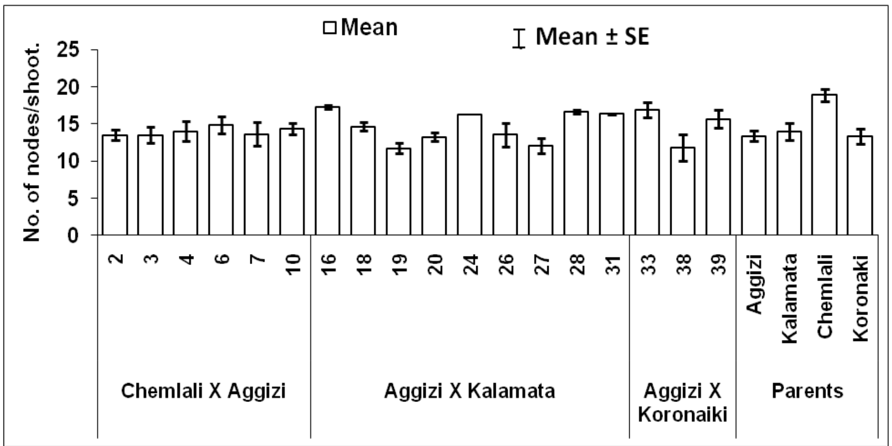

Fig. (3): Mean and standard error during three seasons for no. of nodes /shoot of the olive progenies.

The leaf surface area varied among the tested progenies as shown in Fig. (6). The progenies derived from (Aggizi x kalamata) gave the highest values than cv. Aggizi , but less than cv. kalamata . Whereas the lowest value was obtained in the progeny No. 33 (Aggizi x Koronaiki), the rest progenies gave intermediate values.
oronaiki). The standard error is ranging from 0.03 to 0.38.

3-Leaf shape.

Data in Fig. (7) showed that the progenies No (4, 6, 7) derived from (chemlali x Aggizi) as will as progenies No (31,26 16, 24,27,28,) derived from (Aggizi x Kalamata) and Progenies No (39, 33,) derived from (Aggizi x koronaiki) tooke Elliptic lancedate leaf shape like chemlali , Kalamata and koronaiki cvs.

Differences in growth characteristics among olive selections are in close conformity with the findings previously reported by many researchers (Bellini *et al.*, 1990, 2000, Rallo, 1995, Trigui 1996, Damijela Polyuha., *et al* 2008, Pritsa *et al*., 2003, Bartolini *et al*.,2006, and Bellini *et al.*, 2008).

- **Flowering**

1 -Flowering time:

Data in Table (2) Indicated that the progenies derived from cvs. (Chemlali x Aggizi) began flowering during Mar. 12-27 meanwhile the progenies derived from cvs. (Aggizi x Kalamata) began flowering during Mar. 10-25; the third group of progenies, flowering began during Mar. 15-20.

2- Number of total flowers/inflorescence:

It is clear from Fig. (8) that the mean number of flowers/ inflorescence is 20.39. The progenies No. 26 (Aggizi x Kalamata), No 7, 2, 10 and 6 (Chemlali x Aggizi) attained the highest number of flowers/ inflorescence, but less than Chemlali cv. On the other hand, the progeny No. 18 (Aggizi x Kalamata) had the lowest value and the rest progenies gave intermediate values.

Table (2): Time of flowering

Progeny No	Start of flowering	End of flowering
2	27-3	20-4
3	20-3	12-4
4	22-3	15-4
6	15-3	8-4
7	12-3	7-4
10	17-3	11-4
16	15-3	12-4
18	12-3	5-4
19	11-3	3-4
20	15-3	9-4
24	10-3	1-4
26	10-3	1-4
27	20-3	12-4
31	25-3	15-4
33	15-3	7-4
38	16-3	5-4
39	20-3	10-4
Aggizi	10-3	3-4
Kalamata	28-3	23-4
Chemlali	25-3	19-4
Koronaiki	22-3	20-4

3- Number of perfect flowers/ inflorescence:

Data in Fig (9) indicated marked variation among progenies. The highest values of perfect flowers were in progenies No. 26 (Aggizi x Kalamata), No 7, 2, 4 (Chemlali x Aggizi)) than cvs. Chemlali, Aggizi and Kalamata.

4- Number of staminate flowers/ inflorescence:

It is noticed from Fig. (10) that the progenies No. 26, (Aggizi x Kalamata), No 4 , 7 and 2 (Chemlali x Aggizi) gave the lowest value than cvs. Chemlali, Aggizi and Kalamata while the progeny No. 28 (Aggizi x Kalamata) gave the highest value and the rest progenies gave intermediate numbers.

5- Inflorescence length:

According to Fig. (11) the progenies No. 4 , 2 (Chemlali x Aggizi) and No.26 (Aggizi x Kalamata) gave the highest value than cvs. Aggizi, Chemlali and Kalamata, while the progenies No. 20, 16 (Aggizi x Kalamata) gave the lowest value.

Differences in growth characteristics among olive progenies are in close conformity with the findings previously reported by Bellini *et al.*, (2000), Ferri *et al.* (2006) and Bellini *et al.* (2008).

6 -Sex ratio:

Data in Fig. (12) illuminated the progenies No. 26 (Aggizi x Kalamata), No 7, 4 and 2 (Chemlali x Aggizi) gave the highest value than the cvs. Chemlali, Aggizi and kalamata while the progenies No. 20, 19 (Aggizi x Kalamata) had the lowest value and the rest progenies gave intermediate values.

7-Fruit set/m:

It is obvious from Fig. (13) that the highest value of fruit set was noticed on progenies No. 19, 26 and 28 (Aggizi x Kalamata) than cvs. Aggizi and Kalamata conversely, the lowest values were obtained by progeny No. 31 (Aggizi x Kalamata).

- **Fruiting:**

1- Production:

Data reported in Fig (14) Showed that the progenies No. 38, 39 and 33 (Aggizi x Koronaiki) were the most promising progenies in producing highest yield, that ranged between 47.33 to 49.92 kg /tree than the parents cvs. Aggizi and Koronaiki, followed by progenies No. 26, 27, 24 (Aggizi x Kalamata), also rather than the parents cvs. Aggizi and Kalamata and following No. 2, 10, 3 and 6 (chemlali x Aggizi) more than cv. Aggizi but less than cv. chemlali. The least total yield was produced by the progeny No. 31 (Aggizi x Kalamata).

The progenies No. 38, 39, 33 (Aggizi x Koronaiki) yielded constant productivity during the three years. The standard error is ranging for those progenies is ranging from 0.79 to 1.76; also the progeny No. 27 (Aggizi x Kalamata) gave constant productivity the standard error is 1.58.

Similar results in the Olive Germoplasm Bank of Cordoba showed mean accumulated fruit yield in the first three years of bearing from 2 to 52 kg per tree among cultivars (Leon *et al.,* 2006).

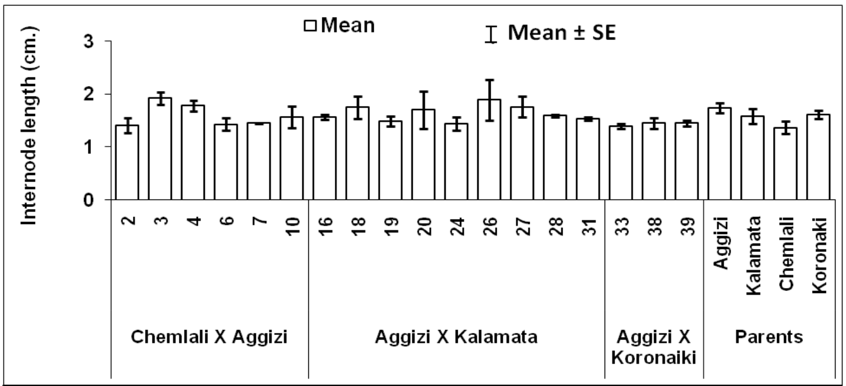

Fig. (4): Mean and standard error during three seasons for internode length (cm.) of the olive progenies.

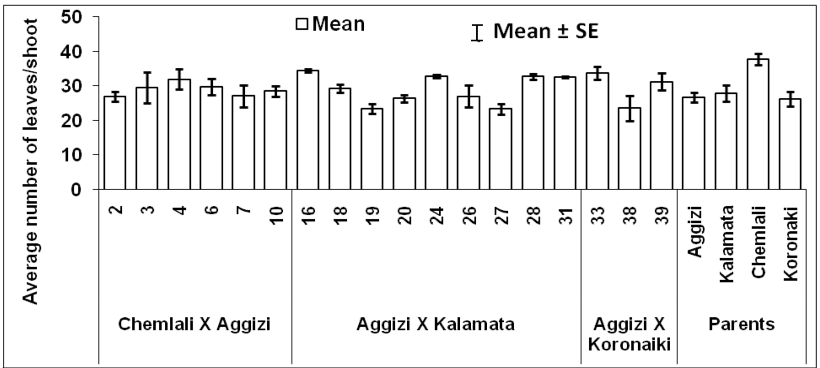

Fig. (5): Mean and standard error during three seasons for average number of leaves /shootof the olive progenies.

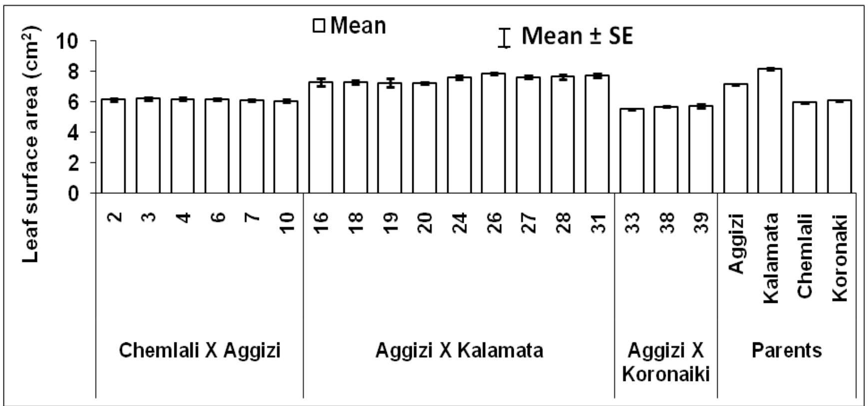

Fig. (6): Mean and standard error during three seasons for leaf surface area (cm^2) of the olive progenies.

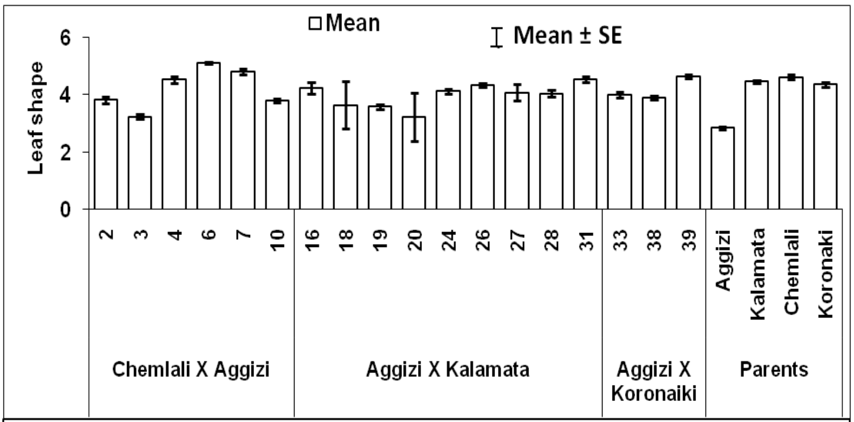

Fig. (7): Mean and standard error during three seasons for leaf shape of the olive progenies.

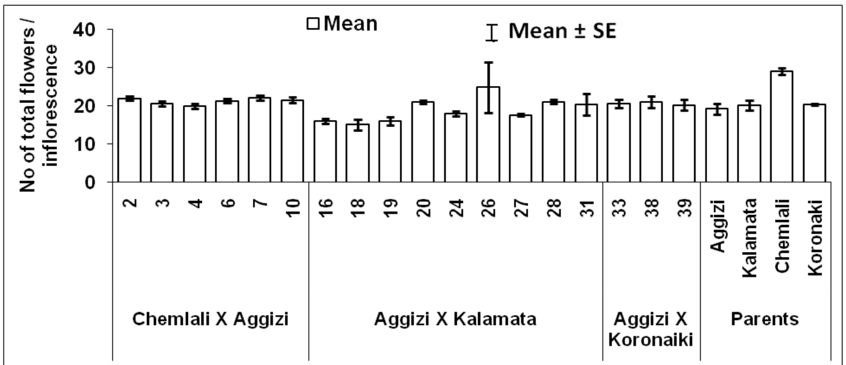

Fig. (8): Mean and standard error during three seasons for no of total flowers / Inflorescenceof the olive progenies.

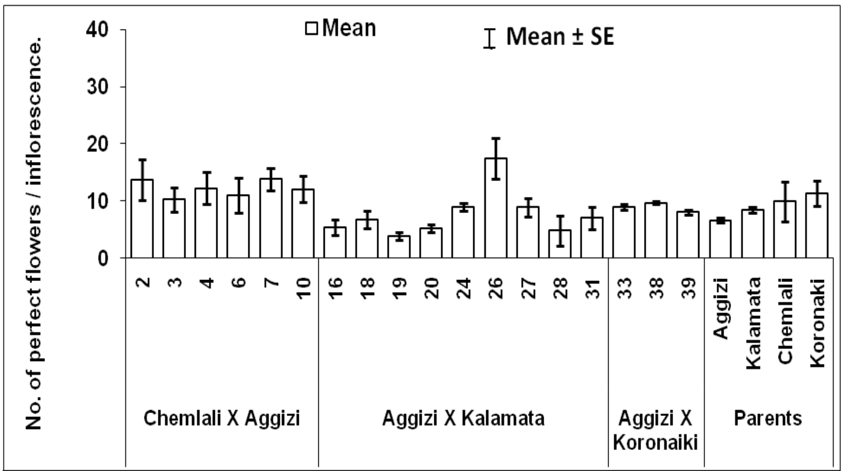

Fig. (9): Mean and standard error during three seasons for No. of perfect flowers / inflorescenceof the olive progenies.

2-Fruit shape:

Data in Fig (15) showed that progenies No 3, 4, 7 resulted from (Chemlali x Aggizi) take elongated fruit shape like cv. Chemlali , but progenies No 2 ,6 resulted also from (Chemlali x Aggizi) took the ovoid fruit shape like cv. Aggizi, progenies No 18, 20, 24, 26, 27 and 31 resulted from (Aggizi x Kalamata) took ovoid fruit shape like cv. Aggizi and the last group progenies No 33, 38, 39 derived from (Aggizi x koronaiki) take ovoid fruit shape like cv. Aggizi..

3-Fruit weight, stone weight, flesh weight and flesh/stone:

Data presented in Fig. (16, 17, 18 and 19) showed that the progenies derived from (Aggizi x Kalamata) produced the highest fruit weight; it was ranging between 6.34 to 7.27 gm, more than the fruits for cvs. Aggizi and Kalamata while the progenies derived from (Chemlali x Aggizi) gave the lightest fruit weight; it was ranging from 1.63 to 1.84.gm. On the other hand, the progenies derived from (Aggizi x Koronaiki) gave the intermediate; it is ranging between 5.78 to 5.90 gm.

Concerning the stone weight and flesh weight they took an analogues trend to the fruit weight. As for determination of flesh to stone ratio, the resulting progenies showed a large variation in this parameter, ranging from 4.73 to 8.30, the highest value of F/S ratio was noticed with progeny No. 31 (Aggizi x Kalamata) more than cvs. Parents, followed by progenies No. 39, 33 and No. 38 (Aggizi x koronaiki) also more than cvs. parents. The F/S ratio is extremely important because it is an indication for oil content.

4-Moisture content:

Moisture content is a major factor for olives as it generally contributes to more that 50 % of the fruit weight. Data in Fig (20) showed that the mean moisture was generally high, around 67.58%. The progenies derived from (Chemlali x Aggizi) showed that the moisture was ranging from 63.46 to 66.77 %, as well as the progenies derived from Aggizi x kalamata) showed that the moisture content was ranging between 68.64 to 71.81,and the last group progenies derived from (Aggizi x koronaiki) showed that the moisture content was ranging between 65.97 to 66.22.

Moisture content of the fruit is important to oil quality for a number of reasons, If the fruit moisture level drops to a point where desiccation occurs cell break down can follow leading to increase free fatty acids and therefore lower oil quality (Ayton, *et al.*, 2001).

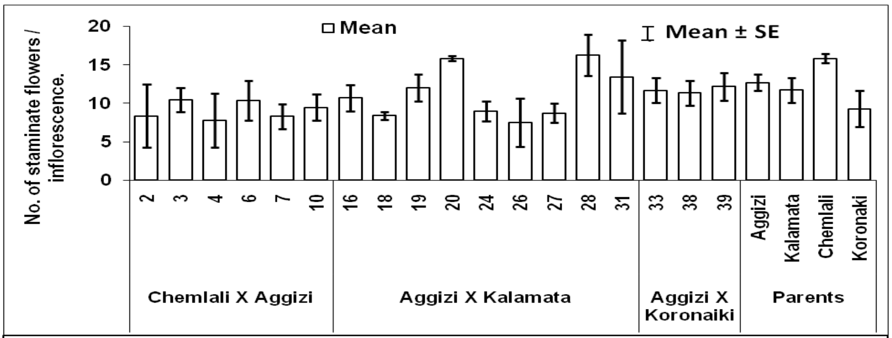

Fig. (10): Mean and standard error during three seasons for No of staminate flowers / Inflorescence of the olive progenies.

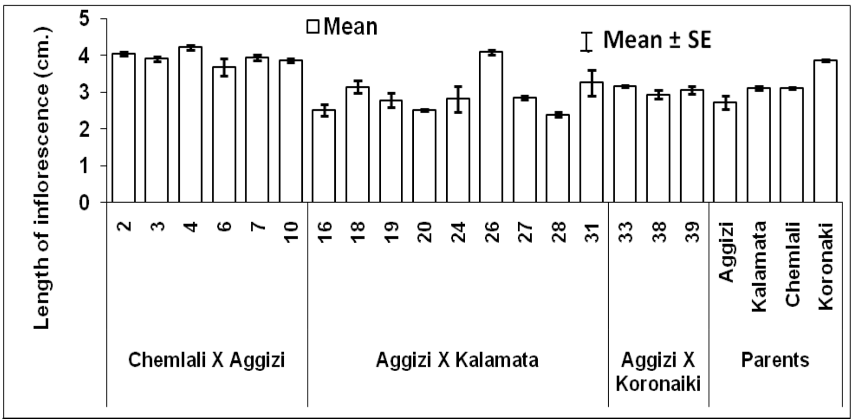

Fig. (11): Mean and standard error during three seasons for length of inflor.escence (cm.) of the olive progenies.

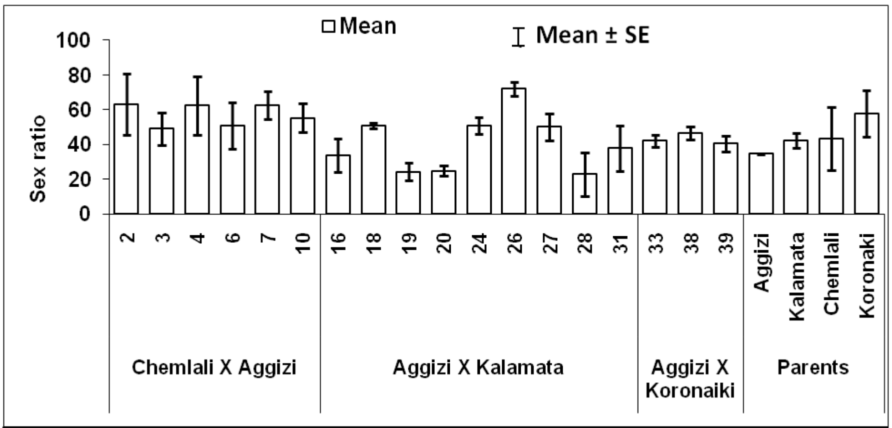

Fig. (12): Mean and standard error during three seasons for Sex ratio of the olive progenies.

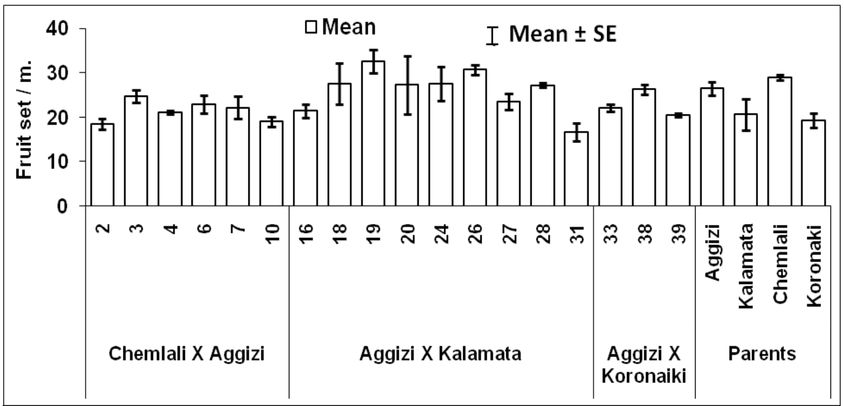

Fig. (13): Mean and standard error during three seasons for fruit set / m of the olive progenies.

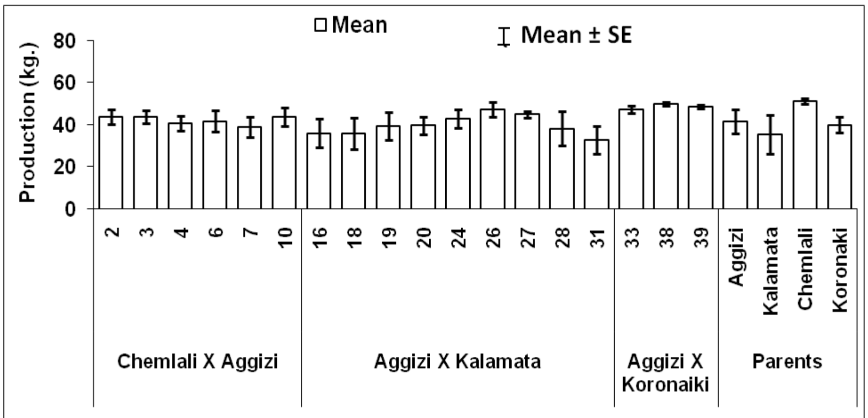

Fig. (14): Mean and standard error during three seasons for production (kg.) of the olive progenies.

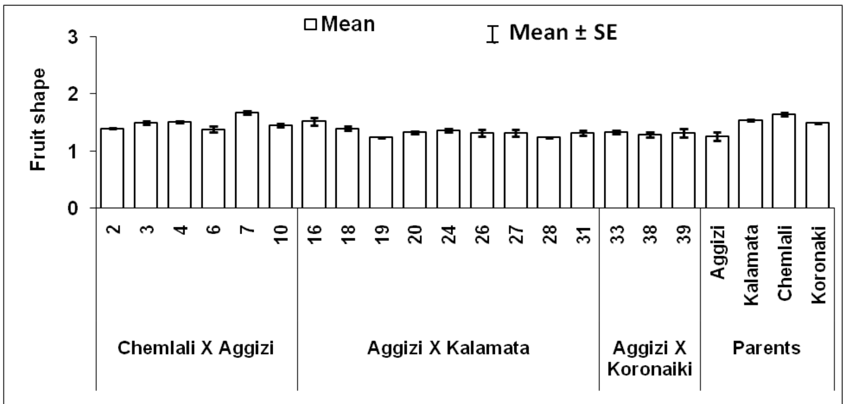

Fig. (15): Mean and standard error during three seasons for fruit shape of the olive progenies.

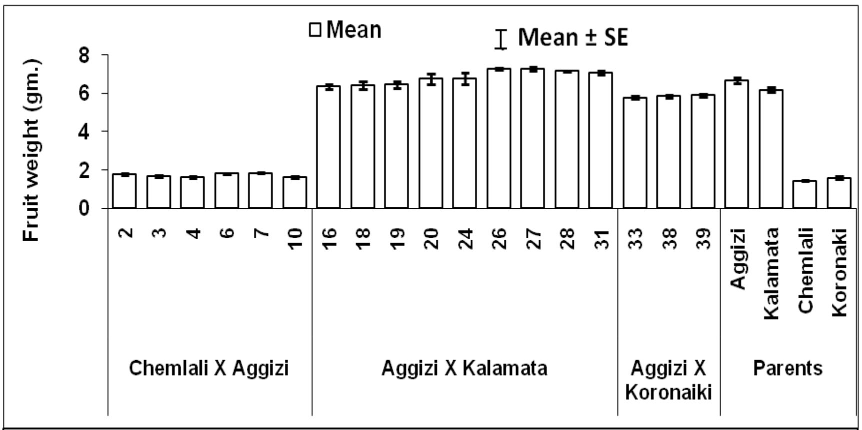

Fig. (16): Mean and standard error during three seasons for fruit weight (gm.) of the olive progenies.

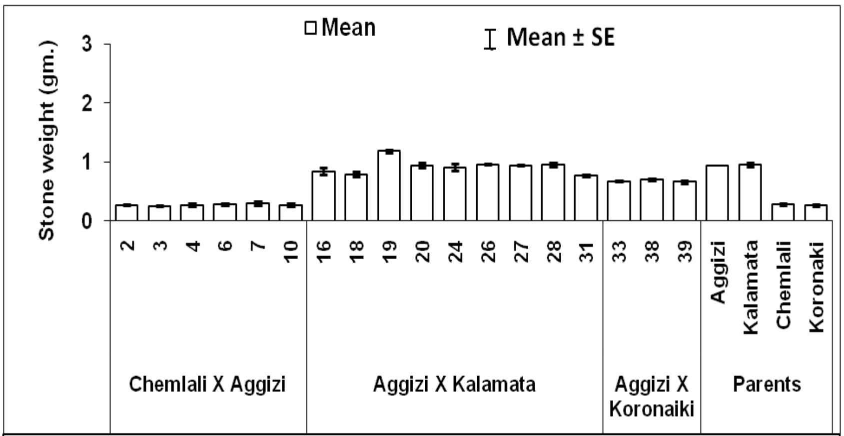

Fig. (17): Mean and standard error during three seasons for stone weight (gm.) of the olive progenies.

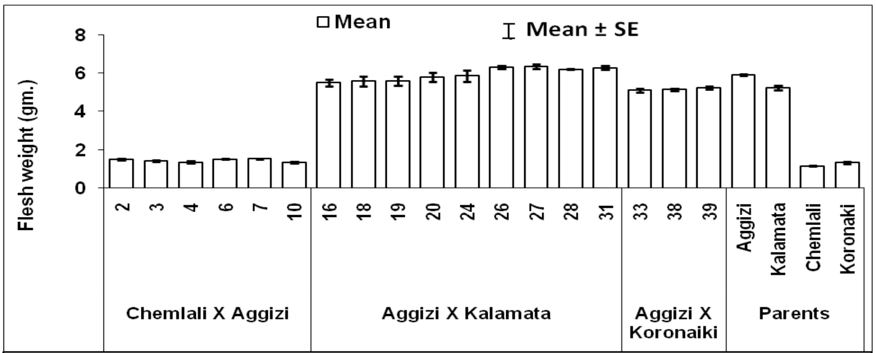

Fig. (18): Mean and standard error during three seasons for flesh weight (gm.) of the olive progenies.

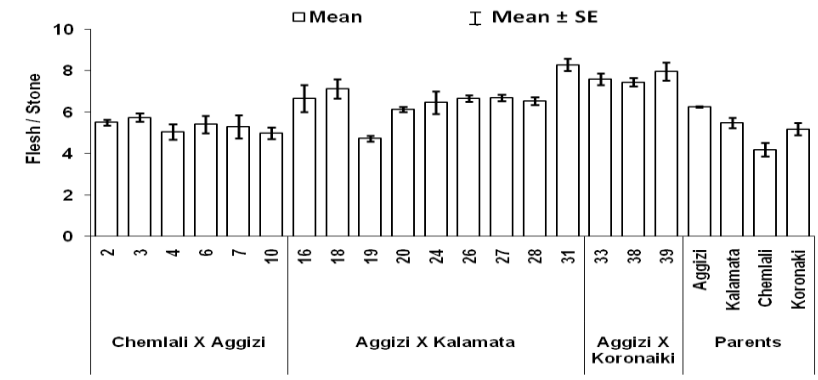

Fig. (19): Mean and standard error during three seasons for flesh / stone of the olive progenies.

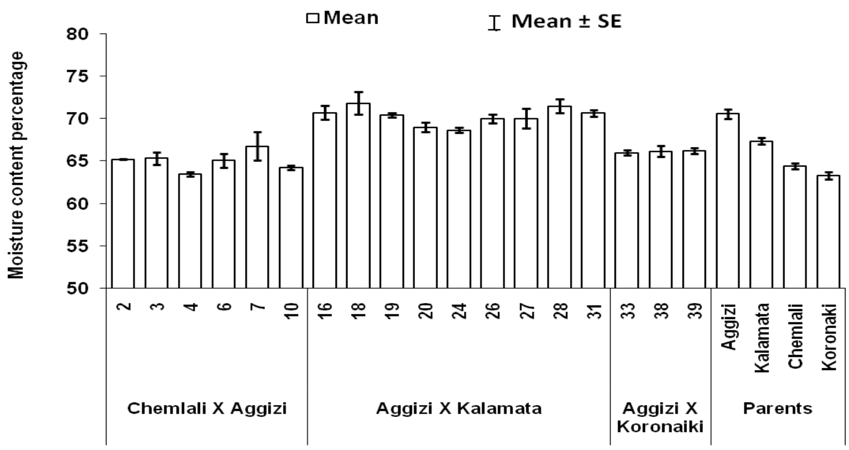

Fig. (20): Mean and standard error during three seasons for moisture content percentage of the olive progenies.

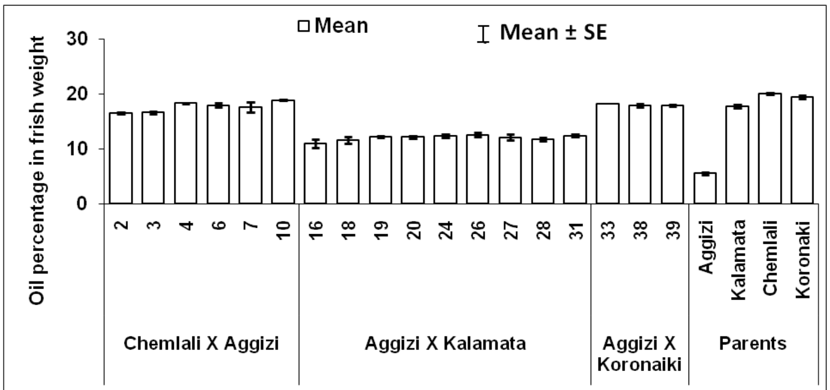

Fig. (21): Mean and standard error during three seasons for oil percentage in frish weight of the olive progenies.

5-Oil content in fresh weight:

Olive fruit yield and oil content are the major contributors to profitability for olive growers. The average oil % extracted was determined and is illustrated in Fig. (21) oil content is expressed as a percentage of the fresh weight of olives.

The progenies derived from (Chemlali x Aggizi) showed that the oil content was ranging from 16.59%, to 18.82 %, on the other side the progenies derived from (Aggizi x Kalamata) showed that the oil content was ranging from 10.96% to 12.59%, and the last group progenies derived from (Aggizi x koronaiki) showed that the oil content was ranging between 17.87% to 18.15%.

- Summery of best characteristics

Progenies No	Characteristics				
	Productivity	Constant productivity	Fruit weight	Flesh/ stone	Oil content in dry weigh
2	43.92	alternate	Very low	medium	Medium
3	43.67	alternate	Very low	medium	Medium
4	40.92	alternate	Very low	medium	Medium
6	41.83	alternate	Very low	medium	Medium
7	39.00	alternate	Very low	medium	High
10	43.75	alternate	Very low	medium	High
16	36.08	alternate	high	medium	Low
18	36.00	alternate	high	medium	Low
19	39.42	alternate	high	low	Low
20	39.67	alternate	high	medium	Low
24	43.oo	alternate	high	medium	Low
26	٤7.33	alternate	high	medium	medium
27	٤٥.08	Constant	high	medium	medium
28	38.17	alternate	high	medium	medium
31	32.67	alternate	high	high	medium
33	47.33	Constant	medium	high	high
38	49.92	Constant	medium	high	high
39	48.67	Constant	medium	high	high
Aggizi	41.67	alternate	high	medium	very low
Kalamata	35.33	alternate	high	medium	high
Chemlali	51.50	Constant	very low	low	high
Koronaiki	40.08	alternate	very low	medium	high

For table olive we choose progenies No.24, 26, 27, 31
For oil we choose progenies No. 7, 10,
For dual purpose No. 33, 38, and 39.

6-Oil percent in dry weight:

Because fresh weight is influenced by several factors such as a tree crop and climatic conditions, oil content on a fresh weight cannot be take into consideration in a comparative quality .This is reason for using oil content per olive as a fixed criterion, disregarding weight.

Data presented in Fig. (22) clearly indicate that oil content in dry weight was ranging from 47.88 to 52.90. % in progenies derived from (Chemlali x Aggizi), but less than cv. Chemlalia. On the other side, the progenies derived from (Aggizi x Kalamata) showed that the oil content was ranging from 37.29 to 42 28%, and the last group progenies derived from (Aggizi x koronaiki) showed that the oil content was ranging between 52.89% to 56.17%.and gave the high oil percent in dry weight and more than cv. Koronaiki .

% **Rooting ability:**

Rooting ability of the semi hardwood cutting is illustrated in Fig. (23) It is varied from 7.75 to 17.25. All the progenies were classified as with weak ability of rooting.

All the best selected progenies should propagated and planted in three locations, in order to evaluate their performance in different geographical areas, (i.e., tree growth, yield, fruit characteristics, oil content, oil compositions in fatty acids fruit compounds, it remains necessary to study qualitative and qualitative traits of olive production in more detail for the most interesting selection.

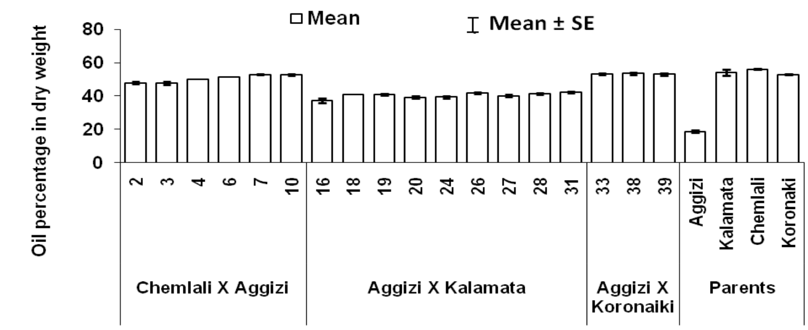

Fig. (22): Mean and standard error during three seasons for oil percentage in dry weight of the olive progenies.

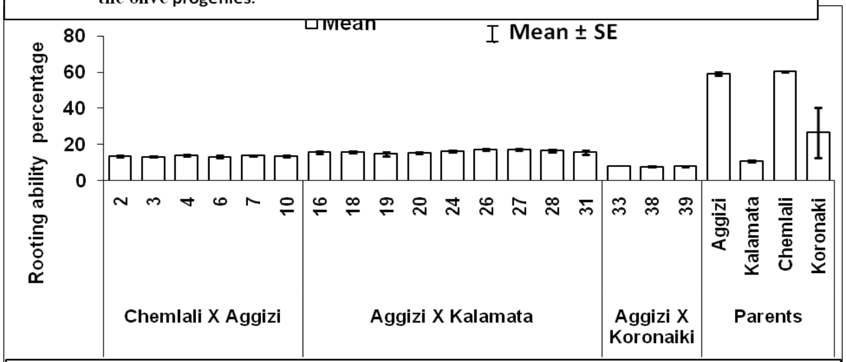

Fig. (23): Mean and standard error during three seasons for Rooting abitliy percentage of the olive progenies.

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تقييم بعض هجن الزيتون الناتجة من برنامج التحسين الوراثى

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تتطلب صناعة الزيتون أصناف جديدة لتواكب الجديد فى هذه الصناعة ولإنتاج أصناف جديدة من أصناف المائدة وأصناف الزيت وثنائية الغرض. أنشىء برنامج التربية منذ عام ١٩٩٤ للتهجين بين الأصناف المحلية والأجنبية.

وخلال ثلاث سنوات تم تقييم هذه الهجن الناتجة من التهجين من (شملالى × عجيزى)، (عجيزى × كلاماتا) و(عجيزى × كروناكى)، وتم دراسة هذه السلالات وتقييم صفاتها (طول الفرع – سمك الفرع وعدد العقد على الأفرع الأوراق (متوسط عدد الأوراق على الفرع – شكل الورقة)– التزهير (ميعاد التزهير، عدد الأزهار الكلية فى النورة، عدد الأزهار الكاملة فى النورة وعدد الأزهار الخنثى فى النورة – طول النورة الزهرية، النسبة الجنسية) الإثمار(يشمل الإنتاج – شكل الثمرة وزن الثمرة – وزن البذرة – وزن اللحم – وزن اللحم/البذرة) – والقدرة على التجذير.

وتشير النتائج المتحصل عليها أن أحسن الهجن لإنتاج زيتون مائدة هى رقم٢٤؛ ٢٦، ٢٧ ،٣١ولإنتاج الزيت رقم٧، ١٠ولانتاج ثنائى الغرض ٣٣، ٣٨، ٣٩

لذلك يمكن التوصية بإجراء تكاثر لهذه الهجن الصفات فى مناطق مختلفة جغرافياً وتشمل صفات الشجرة (نمو الشجرة، وتزرع شتلات هذه الهجن فى ثلاث أماكن مختلفة وذلك لتقييم صفات الثمار، نسبة الزيت، تركيب الاحماض الدهنية فى الزيت) ومن الاهمية دراسة الصفات الكمية والنوعية للانتاج اكثر تفصيلا للهجن الاكثر تميزا